VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE

REPORT NO. 1

ABSTRACTS OF VIRGIN ISLANDS BIOSPHERE RESERVE RESEARCH REPORTS, Nos. 2 - 28

U.S. MAN AND THE BIOSPHERE PROGRAM

Virgin Islands National Park

September, 1988

ABSTRACTS OF VIRGIN ISLANDS BIOSPHERE RESERVE RESEARCH REPORTS
Nos. 2 - 28

1988

BIOSPHERE RESERVE REPORT NO. 1

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

AND

VIRGIN ISLANDS RESOURCE MANAGEMENT COOPERATIVE
VIRGIN ISLANDS NATIONAL PARK
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ISLAND RESOURCES FOUNDATION
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(NPS CONTRACT NO. CX-0001-3-0048)

INTRODUCTION TO
THE VIRGIN ISLANDS BIOSPHERE RESERVE
RESEARCH REPORT SERIES

The Virgin Islands Biosphere Reserve Research Report series constitutes 28 technical documents plus a comprehensive synthesis report, all of which focus on the resource base of the Virgin Islands National Park on the island of St. John, designated by UNESCO as an international Biosphere Reserve. With funding provided by the U.S. National Park Service, this five year research effort (1983-88) involved more than half of the member institutions of the Virgin Islands Resource Management Cooperative (VIRMC), under whose aegis the project was carried out.

The Virgin Islands Resource Management Cooperative was formed in 1982, with the following institutions or agencies in the U.S. and British Virgin Islands and Puerto Rico as signatories to the Memorandum of Understanding: Virgin Islands National Park, the Department of Planning and Natural Resources of the U.S. Virgin Islands Government (Division of Fish and Wildlife and Division of Natural Resources Management), University of the Virgin Islands, West Indies Laboratory, Island Resources Foundation, Eastern Caribbean Natural Area Management Program, U.S. Geological Survey, U.S. Fish and Wildlife Service, Southern Forest Experiment Station, University of Puerto Rico (Sea Grant Program and the Center for Energy and Environment Research), Caribbean Fishery Management Council, the Ministry of Natural Resources and Labor of the British Virgin Islands Government, and the British Virgin Islands National Parks Trust.

The overall objectives of the Cooperative have been defined as follows:

1. To provide an opportunity for coordinated research, extension, and educational support programs designed to achieve the full benefits of island resources for cultural, social, commercial, economic, and recreational utilization and enjoyment.

2. To provide for cooperative activities and relationships among participating parties in the Cooperative and with other agencies and institutions.

3. To coordinate and facilitate financial and other support for research on environmentally acceptable uses of island resources in order to provide for their better management.

4. To provide for the collective utilization of the unique attributes and resources of the participating institutions.

5. To plan for appropriate dissemination, publication, and application of research and information.

The abstracts which follow summarize each of the research reports in the series. Copies of the full documents may be requested by writing to Island Resources Foundation, a member institution of VIRMC which has served as the prime contractor, program manager and publication series editor. (Contact: Island Resources Foundation, Red Hook Center Box 33, St. Thomas, U.S. Virgin Islands 00802.)

For more information on the Virgin Islands Resource Management Cooperative and on the Virgin Islands Biosphere Reserve, please write: VIRMC Executive Officer, V.I. National Park, Post Office Box 710, Cruz Bay, St. John, U.S. Virgin Islands 00831.

September 1988

Virgin Islands Resource Management Cooperative

NEW TECHNICAL PUBLICATION SERIES
COASTAL RESOURCE ASSESSMENT and MANAGEMENT REPORTS
St. John, U.S. Virgin Islands

The following reports have been published jointly by the U.S. National Park Service and the Virgin Islands Resource Management Cooperative (VIRMC), 1986-88, as a part of ongoing research, resource management, and educational activities related to the Virgin Islands Biosphere Reserve on the island of St. John. Photo-copies of individual reports in the series may be purchased from Island Resources Foundation, which has acted as the local contracting agent for VIRMC since its formation in 1982. N.B. A LIMITED NUMBER OF PRINTED COPIES OF THE VIRMC REPORTS ARE AVAILABLE FOR DISTRIBUTION AT NO CHARGE. WHILE THIS SUPPLY LASTS, COPIES WILL BE SENT FOR POSTAGE AND HANDLING COSTS ONLY (one copy only of each report per institution or individual). For more information on the Virgin Islands Resource Management Cooperative, please write: VIRMC Executive Officer, V.I. National Park, Post Office Box 710, Cruz Bay, St. John, Virgin Islands 00831.

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A 30 minute video tape on the "biosphere reserve" concept as a resource management tool for developing countries is also available. The tape focuses specifically on a workshop held at Caneel Bay, St. John in 1983 at the time the Virgin Islands National Park was formally dedicated as a international biosphere reserve, the only such site recognized by UNESCO in the Eastern Caribbean. A loan copy of the VIRGIN ISLANDS BIOSPHERE RESERVE video tape is available for a $75.00 refundable deposit (specify whether 3/4" or 1/2" tape is required). A copy of the tape can also be purchased from the Foundation for $90.00.

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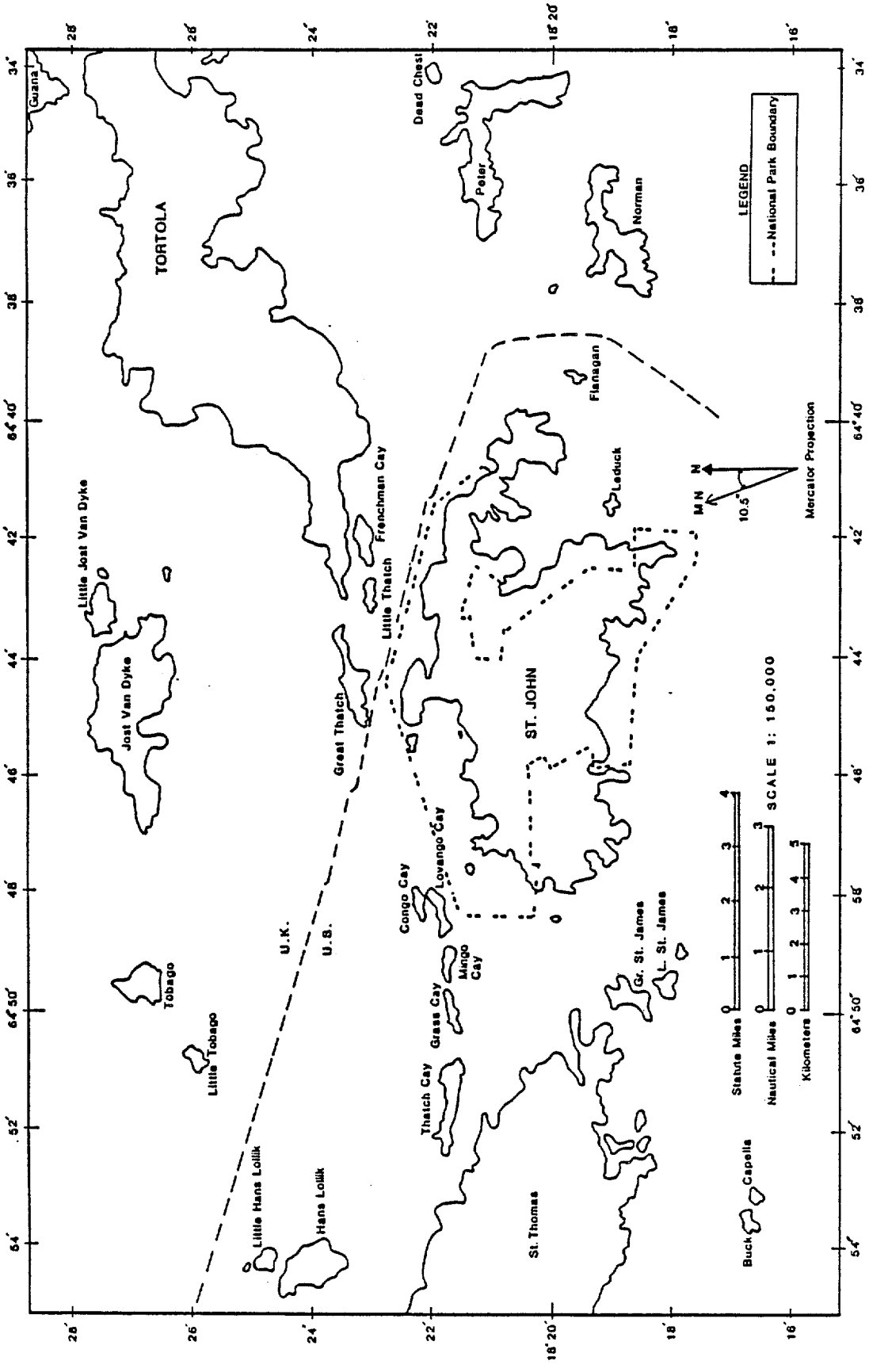

Location Map, St. John, U.S. Virgin Islands (Source: Modified After NOAA, 1972)

Abstract

Biosphere Reserve Research Report No. 2

MARINE COMMUNITY DESCRIPTIONS AND MAPS OF BAYS WITHIN THE VIRGIN ISLANDS NATIONAL PARK/BIOSPHERE RESERVE

A series of benthic maps were prepared representing the marine habitats of the bays of St. John, U.S. Virgin Islands. The maps were drafted from National Oceanographic Service aerial photographs and enhanced using existing photographs, charts and publications. All bays within Virgin Islands National Park boundaries were groundtruthed and described using standard methods adopted by the Virgin Islands Resource Management Cooperative. The major zones were identified and designated based on dominant physical and/or biotic components. A detailed description of major marine zones within each bay was prepared. Relative abundance, condition and percent cover of major species were estimated along with substrate composition and complexity. A summary of the marine zones and their relative condition within each bay and a list of general observations are presented.

St. John and the surrounding small islands of the northern Virgin Islands are of volcanic origin with precipitous slopes ascending from the flat Puerto Rican platform. Typical of these steep, volcanic islands, St. John does not have an extensive bank barrier reef system. However, the complex topography of the island, cays and associated formations yield a great diversity of marine communities.

Sedimentation, visitor damage, vessel anchor damage, beach erosion and illegal harvesting were noted problems within the Biosphere Reserve. Special emphasis was given to bays designated as 'areas of particular concern.' These areas of impact or potential impact were noted and described in greater detail. Two areas, Hawksnest and Fish Bays, were chosen for establishment of long-term phototransect monitoring.

A review of methodologies used from mapping and characterizing marine communities was prepared. The emphasis was on efficient, cost-effective methods which would be of practical use throughout the Caribbean.

Abstract

Biosphere Reserve Research Report No. 3

COLLECTION OF COMMON ORGANISMS WITHIN THE VIRGIN ISLANDS NATIONAL PARK/BIOSPHERE RESERVE, ST. JOHN, USVI

A scientific collection of the common marine macrofauna and macroflora within the Virgin Islands National Park was prepared to enhance the existing Virgin Islands National Park Marine Specimens Collection. Major emphasis was given to evaluation of the existing collection and preparation of a holdings list of specimens and their relative condition. A general collection was completed for replacement of deteriorated and missing specimens and addition of previously uncollected species. Over 500 specimens were collected, prepared and curated using National Park Service guidelines. Information on collection location, relative abundance, associated species and other relevant data was recorded, listed on note cards and submitted with the collection for reference. Descriptions of proper methods for collection, fixation and preservation methods were prepared for reference.

Additionally, phototransects and quantitative collection/surveys were conducted to provide baseline information for long-term monitoring. The phototransect method is described and results from the quantitative surveys is presented. A list of general observations and recommendations for future collections and adequate curation is included in the report.

Abstract

Biosphere Reserve Research Report No. 4

ECOLOGICAL COMMUNITY TYPE MAPS AND BIOLOGICAL COMMUNITY DESCRIPTIONS FOR BUCK ISLAND REEF NATIONAL MONUMENT AND PROPOSED MARINE PARK SITES IN THE BRITISH VIRGIN ISLANDS

The marine communities of proposed or existing park sites in the British Virgin Islands (BVI) and St. Croix in the U.S. Virgin Islands (USVI) have been surveyed and described. The ten sites in the BVI include Anegada, North Sound, The Baths, Salt Island, Norman Island, Tobago, Little Jost Van Dyke, Cane Garden, Beef Island, The Dogs; Buck Island Reef National Monument, St. Croix was also included in the survey.

A standard procedure was used to describe each site. This is presented in the methods section. Maps outlining the marine communities were drawn from projections of color aerial vertical photographs on existing survey maps of the area outlining land masses. These "working maps" were groundtruthed. The marine communities of each of the eleven sites are presented (1) in a 1:5300 scale map outlining the biological communities, and (2) a text describing the contained communities in both qualitative and quantitative ways. Several transects running from the shoreline seaward across a sequence of marine communities were surveyed in detail. For each transect a 1:1200 profile (showing depth, community type, and substrate) was generated.

Abundance of dominant benthic species, depth, substrate type (e.g., sand, dead coral, live coral) and habitat complexity were noted for each community along the transect and presented in tabular form. Black and white photographs of most of the communities appear as plates. There is a preliminary evaluation of the condition of the biological communities at each site.

Abstract

Biosphere Reserve Research Report No. 5

TRENDS IN RECREATIONAL BOATING IN THE BRITISH VIRGIN ISLANDS, A PRELIMINARY ASSESSMENT OF IMPACT FROM HUMAN ACTIVITIES ON ANCHORAGES AND DEVELOPMENT OF A MONITORING PROGRAM FOR SAFE ANCHORAGES

Recreational boating is a significant component of the tourist industry of the U.S. and British Virgin Islands. This report considers the impact of boating on the marine communities of the islands. The history and growth of the boating industry in the BVI is described. An assessment was made of the direct and indirect impact of boating use of the proposed or existing parks of the British Virgin Islands and St. Croix, USVI as described in Report No.4.

A research plan for monitoring the effects of anchoring on seagrass bed communities and on coral communities is presented. This plan was implemented by the establishment of Long Term Monitoring Stations at two sites on St. John, USVI; Great Lameshur and Francis Bays, and two sites in the BVI: The Baths and Prickly Pear Island, North Sound. There is a brief discussion of studies of the effects of anchoring on benthic communities.

Abstract

Biosphere Reserve Research Report No. 6

GEOGRAPHIC RANGE AND RESEARCH PLAN FOR MONITORING WHITE BAND DISEASE

Species of Acropora are dominant reef framework builders in the Caribbean. White Band Disease (WBD) of these corals has resulted in widespread mortality in a number of Caribbean localities in the past few years. This report presents the results of two surveys of the geographic range of WBD: (1) quantitative estimates of disease related mortality in the proposed or existing park sites in the BVI and USVI (cf. Report No. 4) and (2) qualitative accounts of the extent of the disease in localities throughout the greater Caribbean.

A research plan for monitoring the ecosystem level and organism level changes due to the WBD is presented. The initial implementation of this plan, including the establishment and monitoring of a phototransect is described.

Abstract

Biosphere Reserve Research Report No. 7

MARINE ECOSYSTEMS OF THE LESSER ANTILLES - IDENTIFICATION OF REPRESENTATIVE SITES

This report includes discussion of: (1) scientific criteria to consider in designating a site as a Biosphere Reserve, (2) man's use of the marine ecosystem of the Lesser Antilles, (3) available scientific information (publications, research facilities, projects) focusing on marine ecosystems of the Lesser Antilles and greater Caribbean, (4) methods to evaluate marine ecosystems (5) several coastal marine ecosystems on islands in the Lesser Antilles (Curacao, St. Lucia)

Scientific criteria to be noted in selecting ecosystems appropriate for inclusion in the UNESCO Biosphere Reserve Program include 1) species richness and diversity, 2) organic productivity and trophic composition ,3) habitat complexity, 4) rare species and species interactions and 5) relationship with other ecosystems. Factors modifying these criteria include 1) size, 2) relationship to modifying marine and terrestrial ecosystems, 3) proximity to areas of human population and to areas with existing scientific research facilities and 4) the natural and social history of the area including traditional use patterns.

Abstract

Biosphere Reserve Research Report No. 8

MAP OF FISHERY HABITATS WITHIN THE VIRGIN ISLANDS BIOSPHERE RESERVE

Nineteen naturally occurring and one man-made benthic community habitat types are described in terms of the commercially important fish species assemblages found occurring there. Marine habitat types were mapped for all of St. John from NOS (National Oceanographic Survey) aerial photographs and groundtruthed by divers from January to May 1984 to determine accuracy of mapping and to describe each habitat in detail. Fish species assemblages are determined using a random point, visual census technique which appears to be quite accurate, is easy, fast, and repeatable by anyone with minimal instruction.

Results indicate that each benthic habitat type can be distinctly described in terms of its unique fish species assemblage and life history function. The life history function is viewed as a continuum primarily related to distance from shore and depth with habitats like mangrove shoreline and back reefs being juvenile refuges and deeper offshore habitats like lower fore-reefs and bank patch reefs being mature fish habitats where most reproductive activities take place. Habitat types similar to each other in species assemblage generally share similar structural complexity or structural components. Habitats with greater structural complexity tend to contain a greater number of species.

In addition to demersal fin fish, lobster, conch and whelk are other heavily exploited fishery resources. Lobster populations appear to be quite low and appear to be highest in the deeper, more structurally complex habitats. Conch are less common in shallower habitats, possibly due to overfishing, but are frequently found in the deeper grassbeds seaward of coastal reef systems. With a limited, narrow habitat, which is very accessible to fishermen, whelk populations are extremely low with few large, mature individuals found.

Both migratory pelagic fish species and baitfish require substantial work before enough is known to even attempt to draft management guidelines.

Abstract

Biosphere Reserve Research Report No. 9

FISHERIES HABITAT OF THE VIRGIN ISLANDS REGION OF ECOLOGICAL IMPORTANCE TO THE FISHERY RESOURCES OF THE VIRGIN ISLANDS BIOSPHERE RESERVE

Ten habitat types in eight locations adjacent to the Virgin Islands Biosphere Reserve were selected and sampled for their resident assemblages of commercially important fish species. It is recognized that fishery stocks are distributed and interact without any consideration of man-made boundaries and thus, areas adjacent to the Biosphere Reserve may be ecologically important to the fishery stocks within the Biosphere Reserve. Habitat types which could have high ecological importance can be divided into two groups; nursery habitats (development and recruitment source for adjacent habitats) and reproductive habitats (production of eggs and larvae to supply nursery habitats). However, given the planktonic phase of most reef fish larvae and the migratory nature of the pelagic species of fish as well as conch and lobster, it is difficult to assess the actual influence of any particular reproductive site on the adjacent habitats.

The area sampled with the greatest potential for affecting fishery stocks in the Biosphere Reserve is the Coral Bay/Hurricane Hole area on St. John. Its importance as a nursery/juvenile refuge habitat is well documented and its location to windward (up current) of a large portion of the Biosphere Reserve makes the inter-relationship very strong. It is strongly recommended that this nursery/juvenile refuge habitat be considered as a protected area, particularly the Hurricane Hole portion of Coral Bay, as the National Park Service does have control over the coastland bordering these bodies of water.

Although the actual influence is not quantifiable, certain offshore habitats with high reproductive value (raised bank pavement for lobsters and fish; deep algal plains for conch) must also be considered in trying to put together the overall picture. These offshore habitats occur in both the United States and British Virgin Islands and may affect one as well as the other due to our proximity.

It is therefore recommended that the Virgin Islands Biosphere Reserve concept be expanded to consider some of the adjacent areas which may be inter-related with fishery stocks within the Biosphere Reserve. Research on actual inter-relationships, protection from development and management for sustainable yield are all of high importance.

Abstract

Biosphere Reserve Research Report No. 10

ASSESSMENT OF FISH AND SHELLFISH STOCKS PRODUCED IN THE BIOSPHERE RESERVE

At the present time there are no data and no methodologies that are suitable for assessing the production from fishery stocks in such a small and arbitrarily defined geographic area as that of the Biosphere Reserve. For management purposes it is recommended that the Biosphere Reserve utilize the data and management measures which are produced and recommended by the Caribbean Fishery Management Council for the geological platform of Puerto Rico and the northern Virgin Islands.

The entire platform contains stocks which are probably as discrete as any marine stocks can be. Until their relationship to the pan-Caribbean species, of which they are members, can be quantified they should be managed as distinct populations but not as populations confined to politically defined areas within the naturally isolated platform.

The very complex nature of tropical coral reef, grassbed, mangrove ecosystems and the small-scale fisheries which depend upon them, pose many problems for managers. The number of species entering the landings, the difficulty of obtaining statistical data from the scattered points of landing and the lack of middlemen and processors in the fishery make the use of usual mathematical techniques suspect for such fisheries.

Moreover, in contrast to more highly capitalized commercial fisheries of other regions, the socio-cultural aspects of island fisheries become of relatively greater importance than the purely economic aspects. Fishery development projects in these tropical island shelf environments have a notably high rate of failure. Some of the factors which contribute to the failures are (1) the inability of political and economic developers to accept the low productivity and fragility of the fishery stocks on the platforms (2) the imposition of highly capitalized and mechanized fishing efforts on the system and (3) a misunderstanding of the actual role that small-scale fisheries play in the lives and well-being of indigenous people.

Abstract

Biosphere Reserve Research Report No. 11

UTILIZATION OF THE VIRGIN ISLANDS BIOSPHERE RESERVE BY ARTISANAL FISHERMEN

Catch and landings on St. John are described for a six-month period (January to June 1981). Methods include port interviews, annual catch reports, informal interviews and questionnaires. Resources taken near or landed on St. John by 28 commercial fishermen were categorized into ten different fishing methods. Landings for the period of study total 16,067 pounds (fish, shellfish and crustaceans) for a total value of $38,221. West-Indian fish traps represent the greatest proportion of the landings followed by bottom longline and handlines .

The subsistence fishermen were interviewed and were found to set from one to ten fish traps and some handline fishing. Traps are usually hauled on the weekends and yield from six to fifty pounds of fish per month. Fish are used to supplement the diet provided from regular income.

Most, if not all of the commercial fishing activities take place outside of the Biosphere Reserve. The major impact is socio-economic, rather than resource utilization. The primary resource use impact within the Biosphere Reserve comes from subsistence and recreational fishermen. The majority of subsistence level fishing takes place from Rams Head to East End and south of Cruz Bay. Total fish traps observed in Biosphere Reserve waters are less than two dozen. All lobstering in NPS waters is done by hand and is concentrated around Fish and Reef Bays where grassbeds are more abundant. Hook fish taken in NPS waters is mainly limited to bottom fishing and trolling by recreational vessels, both of which are nearly impossible to sample. BVI fishermen do not appear to fish in these water preferring their own waters which are less overfished.

It appears that little intensive fishing takes place within the Biosphere Reserve/National Park. This area may serve as a refuge for many individuals that would be harvested if they were outside the Biosphere Reserve. This protected area may also serve as a recruitment source and emigration base for areas outside the Biosphere Reserve where fishing pressure is greater. Even with little fishing, the numbers, sizes and species composition could be affected by more intensive fishing outside the Biosphere Reserve , thus, creating an external vacuum producing the same effect as overfishing.

Abstract

Biosphere Reserve Research Report No. 12

SOCIO-ECONOMIC AND CULTURAL ROLE OF FISHING AND SHELLFISHING IN THE VIRGIN ISLANDS BIOSPHERE RESERVE AREA

This paper provides an overview of fishing in the St. John Biosphere Reserve. It focuses on resident fishermen of the island and includes some discussion of fishermen from nearby islands who exploit the resources of this environment. This study is organized into three broad topics. It begins with a description of fishing and fishermen, their methods, the role of fishing in individual economic strategies and the place of fishing in the island's culture and economy. The second topic is an examination of the local marketing of fish. Finally, this report looks at almost four decades of economic development in St. John and the effect of those developments on fishing; in particular, the relationship between the National Park Service and fishermen is examined.

St. John's integration into the American economy, the development of tourism since World War II, and the creation of the Virgin Islands National Park have brought about significant changes in the local culture and have produced both opportunities and costs for residents and resource users. Fishing has become more commercial in response to increased demand. At the same time regulations have been introduced restricting some traditional fishing techniques. Disagreements have developed between fishermen who regard fishing as a birthright and the regulatory agencies charged with protecting the environment. This study identifies some of the issues involved in this debate and suggests that by developing a more participatory management approach, the Virgin Islands Biosphere Reserve Program can lessen the division that exists between resource users and managers.

Abstract

Biosphere Reserve Research Report No. 13

LONG-TERM MONITORING METHODS FOR FISHERIES RESOURCES OF THE VIRGIN ISLANDS BIOSPHERE RESERVE

Long-term monitoring methods of species of demersal fin fish, conch, and whelk that are commercially important were developed and used at selected sites in the VIBR. The techniques used proved objective, repeatable, fast, easy and subject to a minimum of observer bias.

A random-point, visual-census technique was used at habitats with a high fish-species count of demersal fin fish. Of the four bays selected, three (Trunk, Hawksnest, and Fish) have potential for tourist or land-based-sedimentation impact. The fourth, Lameshur Bay, has low impact potential. Baseline data was collected for seven habitat types found in these bays.

A visual, swimming, strip-transect method was used at three sites in two bays (a shallow [inner] and deep [outer] grass bed in Fish Bay and a shallow grass bed in a small bay east of Leinster Bay) to estimate conch densities and population structure. Over a four-month period, the inner site at Fish Bay was composed of juvenile conch in densities ranging from .09-.28 conch/sq.m.; the outer of 99.9% mature conch in densities ranging from .08-.18 conch/sq.m. Sampled twice, the bay east of Leinster Bay was composed of 79% mature conch the first time, and 99% juvenile conch the second time. Densities ranged from .21-.26 conch/sq.m. The shift in population structure may be seasonal (migration).

A random-point, strip-transect method was used for estimating density and population structure of whelk along a rocky coastland between Peter Bay and Windswept Beach (selected due to known low harvest). All whelks within a one-meter-wide strip from dry land to a one-meter depth were collected. The largest population size class is whelks under 1 cm., with 82% of all whelks being less than 4 cm. (approximate average size for maturity). This may indicate that periodic harvesting does occur. The density of whelks is estimated to be 36.7 whelks/m. of shoreline.

Recommendations are made to monitor lobster using a systematic canvassing technique to ensure total coverage and no overlap of a selected, discrete lower fore-reef or bank pavement area. Data on sex (if female, whether berried or not) and size should be gathered. Handling lobster may effect the study and should be avoided.

Abstract

Biosphere Reserve Research Report No. 14

CHARACTERIZATION OF LESSER ANTILLEAN FISHERIES

Island nations which have recently become independent are for the most part intent on developing rather than managing their fisheries. Most of the stocks of the shallow shelf areas are already fully or over-exploited and development must focus on deepwater and pelagic stocks as well as on habitat enhancement. However, this is not widely recognized by political leaders who are faced with expanding human populations and trade deficits.

Almost universally in the Eastern Caribbean, demand for fish exceeds the supply and governments assume that expansion of the fishery sector will automatically correct this situation. While there are limited possibilities for improvement by expansion more permanent solutions lie in the area of management of the coastal fisheries and the habitat necessary to support them indefinitely. Biosphere Reserves have the potential to increase local availability of fish through well-managed use-zones. Conch and spiny lobster offer appealing targets for such management. Marketing and distribution patterns also offer possibilities for enhancing the local supplies of high quality fish products. Such an integrated fisheries management program associated with a Biosphere Reserve could be of substantial benefit to local fishermen.

In 1983, the Organization of Eastern Caribbean States and the Food and Agriculture Organization of the United Nations produced a draft fisheries act and a draft set of fishery regulations to be acted upon by various Eastern Caribbean states. However, lack of local fisheries data and enforcement capabilities have delayed full implementation of such measures. Biosphere Reserves could play a key role in developing public support for a voluntary approach to marine resource management. The artisanal fisherman along with the commercial and recreational components of the fishery would logically be involved in such programs. In many parts of the world fish aggregating devices and artificial habitats are major components of fishery activities and these should be more widely investigated and used in such management programs within Biosphere Reserves along with re-stocking and ranching efforts.

Biosphere Reserves can demonstrate that conservation and development are both directed toward helping people. An education program which involves a great many local fishermen can ultimately lead to voluntary conservation for development and indefinite usage.

Abstract

Biosphere Reserve Research Report No. 15

DATA SYNTHESIS AND DEVELOPMENT OF A BASIS FOR ZONING OF THE VIRGIN ISLANDS BIOSPHERE RESERVE

The Virgin Islands National Park was designated a Biosphere Reserve by Unesco in 1976 and dedicated in 1983. With funding from the National Park Service, the Virgin Islands Resource Management Cooperative (VIRMC) has undertaken a series of studies as part of the Biosphere Reserve Program. This report presents the results of two studies, carried out by the Eastern Caribbean Natural Area Management Program, a member of VIRMC, to synthesize data on (1) the relative size and distribution of marine habitats within the protected areas of the U.S. and British Virgin Islands, (2) marine resource use around St. John, and (3) marine resource issues identified by managers and users (Project I.2.7); and suggest a basis for zoning of the marine portions of the Virgin Islands Biosphere Reserve (Project I.2.9).

Data on the size and distribution of marine habitats of St. John, Buck Island (near St. Croix), and the proposed marine protected areas of the British Virgin Islands, indicate that the Reserve is fairly representative, although lagoon habitats are relatively scarce. Commercial uses of these habitats were determined by interviews and mapped. While fishing, snorkeling, and diving are relatively widespread around St. John, boating activities tend to concentrate in a few bays. The most heavily impacted bays are, in descending order, Cruz, Francis, Cinnamon, Maho, and Hawksnest. Resource users and managers are especially concerned about marine traffic and congestion along the northwest coast of St. John, especially in Francis and Maho Bays, congestion and pollution at Cruz Bay, and the need for improved protection of marine resources in general.

Since the Biosphere Reserve is presently coincident with the National Park, zoning could be based on (1) a "core zone" which would include the least altered areas of the National Park, receive the highest degree of protection, and be used exclusively for nonmanipulative research and training; (2) a "buffer zone" which would include the rest of the non-core areas within the National Park, receive some alteration, and be used for various kinds of research, education and training, tourism and recreation, and traditional fishing; and (3) a "zone of cooperation" which remains undelineated, changes according to the cooperative demonstration projects being undertaken, and includes a variety of sites for study, documentation, and adaptation of traditional resource uses; developing practical means for restoring degraded ecosystems; undertaking ecologically and socially sensitive resource development projects; and training related to the above.

It is recommended that zoning for the Biosphere Reserve be undertaken as part of the development of a management plan with full participation of resource users and relevant federal and territorial resource management agencies. In the meantime, activities should aim at resolving the more immediate resource issues. Highest priority should be accorded working with government and community groups to solve the difficult problems of pollution and congestion in the port of Cruz Bay, and to guide development in the Coral Bay area. Next in priority would be projects to improve resource protection in the more congested bays of the northwestern portion of St. John and to work with fishermen to stimulate the recovery of baitfish stocks.

ABSTRACT

Biosphere Reserve Research Report No. 16

CONCEPTUAL FRAMEWORK FOR THE MANAGEMENT OF THE VIRGIN ISLANDS BIOSPHERE RESERVE

The Virgin Islands National Park was designated a Biosphere Reserve by UNESCO in 1976 and dedicated in 1983. It is part of an international network of areas, representative of the world's natural diversity, managed to integrate conservation and development. Because of the more limited objectives of a national park, a biosphere reserve can only fulfill its purpose if it encompasses a more diverse area, both geographically and conceptually. A fully functioning reserve would seek to develop and disseminate the knowledge, skills and attitudes needed to attain sustainable use of natural resources. Management objectives would cover a range of activities in conservation, research, education, training, communication, and resource development that is sensitive to both man and nature.

The purpose of this report is to outline a conceptual framework for management of a Biosphere Reserve in the Virgin Islands. A synthesis of data on (1) the distribution of marine habitats of the protected areas of the U.S. and British Virgin Islands, (2) marine resource use around St. John, and (3) issues of concern to marine resource managers and users provided much of the background information.

Activities in the Virgin Islands Biosphere Reserve to date have been funded mainly by the National Park Service and implemented through VIRMC. Most progress has been made in research and least in resource development and training. This reflects funding through the Park's research budget which has provided a strong initial impetus to the Program. However, a fully functioning Reserve will evolve more rapidly when the selection of priorities is made within a a coherent and long-term framework, not as an element of research for the National Park.

The evolution of a fully functioning Biosphere Reserve can be promoted by continuing the ongoing research program, adding new activities in resource protection for the heavily used northwestern bays, and guiding sensitive development of the Coral Bay area. These activities should improve cooperation among users and managers and make possible a collaborative approach to designing a Reserve Program that will deal effectively with major resource management issues. An ad hoc committee established for this purpose could evolve into a more formal Reserve Management Committee made up of representatives of the various interest groups and appropriate federal and territorial government agencies. Its function would be to develop and oversee the implementation of a Reserve Management Plan. While much could be accomplished through cooperative arrangements between members of the Management Committee, a strong program would require a small but well trained staff. Funding could either be sought through territorial or federal sources, or perhaps through grants from private foundations. Given the international aspects of the Program, the Management Committee and staff might be most productive working through one of VIRMC's members having a regional perspective, such as the Island Resources Foundation, the Eastern Caribbean Natural Area Management Program, or the newly forming Eastern Caribbean Center of the University of the Virgin Islands.

ABSTRACT

Biosphere Reserve Research Report No. 17

INITIATION OF A LONG-TERM MONITORING PROGRAM FOR CORAL REEFS IN THE VIRGIN ISLANDS NATIONAL PARK

A long-term monitoring program was initiated for the coral reefs of the Virgin Islands National Park and Biosphere Reserve in recognition of the need for quantitative baseline data to provide information for resource assessment and effective management. Major stresses to the reefs in the park include terrigenous runoff, storm damage, and boat damage.

Transects were established on reefs in Reef, Fish, and Hawksnest Bays. During the study period, the most conspicuous damage to St. John's reefs resulted from heavy seas associated with Tropical Storm Klaus in November 1984. The storm resulted in a statistically significant decrease in the mean percent of live coral cover (from 26 to 21), an increase in diversity and evenness, and a slight decrease in spatial index at the Fish Bay site. The percent cover by the dominant coral Agaricia agaricites decreased significantly from 17 to 11. At Reef and Hawksnest Bays (for which there are only post-storm data), mean percent coral cover was 20 and 26, respectively.

Monitoring of changes in the amount of living coral cover and other parameters along the transects on reefs in these three bays will allow assessment of future damage from turbidity and other stresses.

ABSTRACT

Biosphere Reserve Research Report No. 18A

HERBARIUM OF THE VIRGIN ISLANDS NATIONAL PARK: CONSOLIDATION AND CURATION OF A REFERENCE COLLECTION

This report documents the establishment of a reference collection of vascular plants indigenous to or naturalized on St. John, based on collections made by Roy O. Woodbury and associates, largely in 1983 and 1984. Determinations were made almost exclusively by Woodbury. The collections were consolidated, curated and organized by the Virgin Islands Cooperative Extension Service (VICES) under contract to the Virgin Islands Resource Management Cooperative (VIRMC). The St. John reference collection (herbarium) is physically housed at the Virgin Islands Biosphere Reserve Center, Lind Point, St. John, with the voucher (and reference) collections of other organisms.

The Woodbury collection consists of at least 600 species distributed among 99 families, represented by some 1156 mounted specimens (List A of Reference Herbarium List). Sterile specimens in the collections are listed separately in List B. As a convenience and cross-reference, synoptic lists of the included families are provided in phylogenetic and alphabetical order (Lists C and D).

An additional 210 species are listed separately (Appendix I) as sight records, so that the total flora recorded stands at 810, including at least six new species and 12 rare, endangered species. The lists include numbers of specimens per species, and of specimens with inflorescence and/or fruit. Additional fern species noted by G. B. Proctor in 1984, but not in the reference collection, are noted in Appendix II. The VICES retained 185 species (186 sheets) of plants for which there were sufficient numbers of mounted specimens (Appendix III). The entire project served the important goal of enhancing the capability of the University of the V.I. in serving the public in plant-related information outreach through the VICES.

Finally, an overview is presented of floristic studies (published, unpublished, and in progress) on St. John and the Virgin Islands. Information is summarized on existing herbarium collections, floral revisions in progress, endangered species of plants, vegetational structure, and living plant collections in the Virgin Islands.

ABSTRACT

Biosphere Reserve Research Report No. 18B

ESTABLISHMENT AND SOIL CHARACTERIZATION OF LONG-TERM FOREST MONITORING PLOTS IN THE VIRGIN ISLANDS BIOSPHERE RESERVE

Three permanent study plots have been identified and established on St. John, with the overall long-term objective of monitoring representative components of secondary forest development on a small, steep-sloped, dry-to-moist tropical island. The plots are in representative ecological zones -- upland moist forest (Bordeaux), gallery moist forest (L'Esperance) and dry evergreen woodland (Hawksnest), and are 1.0, 0.5 and 0.5 ha in size, resp. They are situated on watersheds of critical importance to the V.I. National Park: Reef Bay, Fish Bay, and Hawksnest Bay, respectively. The bays are the subject of several long-term marine studies by V.I. Resource Management Cooperative and other research groups. The implementation of vegetation and soil studies on these watersheds will allow specific aspects of the association of land and marine systems on this island to be evaluated for the first time.

Pertinent background on events leading to this study are given, as is the rationale for selection of the study areas. Topographic and geological characteristics, and past land-use, of these sites are briefly reviewed.

The regenerating forest is an intriguing mixture of native and introduced species. Comparative study of the relative development of these two groups is likely to be most instructive, and of high relevance to other islands, especially in the Neotropics. Of the twelve species of trees most abundant in one or more of the three plots, eight are discussed briefly in their biological, historical and cultural contexts: Acacia muricata, Andira inermis, Ardisia obovata, Byrsonima coriacea, Guapira fragrans, Inga fagifolia, Pimenta racemosa, and Tabebuia heterophylla.

Soil was sampled at three depths from 33 sites immediately outside the perimeter of the three study plots. The samples were analyzed for pH, soluble salts, organic matter, sodium content, texture, five macronutrients (exchangeable P, K, Ca, Mg, S), and four micronutrients (exchangeable Zn, Fe, Cu, Mn). Nitrogen was not analyzed. The average pH ranged from 5.71 at Bordeaux, to 7.12 at Hawksnest. Percent organic matter was rather high, normal in a forest environment, but the Hawksnest plot was consistently lowest. Most of the nutrients were in the low-to-medium range, with the exception of iron, which was high to very high at the Bordeaux plot. The latter is consistent with the results of a geochemical survey of St. John by Tucker et al. (1985). Some differential in nutrient levels is apparent within and among the study areas, and these could have an effect on plant distribution and growth, but detailed analysis of this is beyond the scope of the present report.

Representative specific recommendations arising from this study are offered, concerning terrestrial plant development, soils and nutrient relationships, as they relate to management considerations and information and education needs in the Virgin Islands.

ABSTRACT

Biosphere Reserve Research Report No. 19

HISTORIC LAND USE IN THE REEF BAY, FISH BAY AND HAWKSNEST BAY WATERSHED ST. JOHN, U.S. VIRGIN ISLANDS (1718-1950)

Historic land use and settlement patterns within the Reef Bay, Fish Bay and Hawksnest Bay watersheds were associated almost exclusively with export-oriented plantation agriculture introduced by European and African colonists after 1717. Aboriginal and post-emancipation peasant subsistence farming was not widely practiced in these study areas.

Energized by imported slave labor the plantations spread throughout the watersheds between 1718 and 1740. Field operations and population densities peaked in the 1770's, but continued at relatively high levels until about 1820. Thereafter, agricultual activities contracted steadily, permitting progressive reforestation of the watersheds. During the first half of the twentieth century no more than 5 percent of total watershed land remained in use.

Analysis of the historical record indicates that plantation agriculture had a profound, yet variable, impact on watershed environments. Plantation fuel, lumber and land requirements resulted in the initial loss of most, if not all, of the indigenous forest cover and its partial replacement with introduced vegetation. On the other hand, truncated plantation development and plantation land management strategies, such as terracing, watercourse controls and selective reforestation, allowed for the persistence of many native plant species and probably moderated soil erosion and sedimentation discharges associated with widespread land clearance and intensive use.

ABSTRACT

Biosphere Reserve Research Report No. 20

A GENERAL REVIEW OF SEDIMENTATION AS IT RELATES TO ENVIRONMENTAL STRESS IN THE VIRGIN ISLANDS BIOSPHERE RESERVE AND THE EASTERN CARIBBEAN IN GENERAL

This report discusses the impacts of sedimentation on tropical marine environments. Because of the greater susceptibility of reefs, the majority of the discussion is aimed at this specific environment. Included are:

1. A review of the general types of sediment stress that occur in marine systems.

2. A discussion of the critical parameters that should be measured in any study of sediment stress.

3. A discussion of sources of sediment stress in the Caribbean, including examples from within the V.I. Biosphere Reserve, the U. S. Virgin Islands and the eastern Caribbean.

4. A more specific treatment of area-wide problems, along with strategies that exist or should exist to cope with them.

This document is not meant to be an exhaustive review of the subject. Rather, it is intended to highlight the problems, provide some reasonable management guidelines, and serve as a starting point for developing future VIRMC projects dealing with this important topic. A synthesis such as this will never totally satisfy the needs of all individuals. Hopefully it can be a useful reference tool for those interested in pursuing the problem further.

ABSTRACT

Biosphere Reserve Research Report No. 21

SEDIMENTATION AND REEF DEVELOPMENT IN HAWKSNEST, FISH AND REEF BAYS, ST. JOHN, U.S. VIRGIN ISLANDS

In recent years, the potential impacts of sedimentation on reef development have been increasingly recognized. With ever-increasing development stress being placed on the upland areas of St. John, both the National Park and local residents have become concerned with the impacts of development on natural resources, and specifically on nearshore reefs. This study was conducted as a first attempt to evaluate the responses of nearshore reefs in three bays over the past two hundred years. Specifically, the impacts of land use on nearshore sedimentation levels were of special interest.

A theoretical study of runoff under natural conditions intimated that the present distribution of reefs around the island are primarily controlled by watershed size, bay geometry and exposure, with recent development exerting a secondary impact. It was established, however, that more frequent (10-25 yr) storms play a very important role in controlling the distribution of reefs around the island. Therefore, it is not necessary to invoke the catastrophic event (e.g. 100-yr storms) to explain the occurrence of modern reefs. From this, it can be argued that development can have significant impact under less than heavy runoff conditions.

Studies of the present distributions of sediment types and reefs in Hawksnest, Fish and Reef Bays point to controls identical to those identified by the more generalized study. Of critical importance in reef development was distance from sources of terrigenous runoff (the guts) and degree of exposure. On a local level, these both outweighed development at its present level. Over the long term, there appears to be a gradual decline in the reefs over the entire period of record, based on X-rayed cores through large coral heads. This may be related to a long-term compromise of the soil retaining capabilities of the upland watersheds following intensive cane farming in the 1700's and 1800's. With the exception of short-term degradation of the nearshore reefs in Hawksnest Bay, however, reef degradation could not be directly linked to any specific development activity.

Based on the findings of this study, specific management strategies are proposed. These include limiting development in main water courses, and establishing reasonable buffers to runoff related to upland construction. Recommendations for future research objectives are also offered.

ABSTRACT

Biosphere Reserve Research Report No. 22

BASIS FOR LONG-TERM MONITORING OF FISH AND SHELLFISH SPECIES IN THE VIRGIN ISLANDS NATIONAL PARK

A long-term monitoring program was initiated for fish and invertebrate species of commercial importance within the Virgin Islands National Park/Biosphere Reserve. Additionally, generally surveys were made for lobsters and conch. Hopefully, the data obtained will begin to fulfill the need for quantitative baseline data to assess and manage these resources adequately.

A one-year study indicates that; 1) some species of reef fish may have seasonal trends in numbers; 2) the inshore spiny lobster (Panulirus argus) population shows summer and winter peaks at Fish Bay but not Reef Bay, where numbers are very low; 3) conch (Strombus gigas) show a definite seasonal trend in deeper water with low numbers during the summer reproductive season; 4) whelk (Cittarium pica) at one study site show a large annual cohort of juveniles decreasing in abundance with increasing size. Few adults are present due to natural mortality. General surveys for conch and lobster demonstrate that the populations are of low abundance and highly dispersed.

These data will be useful to assess population trends in the absence or presence of management actions on the species or species groups. Recommendations for monitoring methodologies and management actions are discussed.

ABSTRACT
Biosphere Reserve Research Report No. 23

MAN'S LONG-TERM IMPACT ON SEDIMENTATION: EVIDENCE FROM SALT POND DEPOSITS

Coastal ecosystems of the Virgin Islands Biosphere Reserve, St. John, are subject to stress of sedimentation from watershed erosion, both natural and man-induced. A pilot study was initiated at Mandal Pond and Reef Bay mangrove swamp on the southern coast of St. John to determine sedimentation rates and to discover if the rates have changed in response to man's historical activity in the watershed. The results reveal the deposits are ordered in time, display horizons and preserve components produced in the pond/swamp or derived from the watershed. Radiocarbon ages of intertidal peat indicate that both sites have submerged at a uniform rate of 0.08 cm/yr. Submergence exceeds sediment infilling at Mandal Pond whereas infilling exceeds submergence at Reef Bay. Consequently, the swamp size at Reef Bay and water depth decrease with time, depositional units change and watershed-derived alluvium encroaches on the swamp. Despite man's activity, no massive effect of sedimentation on the swamp is observed. Man's effects are relatively small in comparison to the long-term natural evolution of the system.

ABSTRACT

Biosphere Reserve Research Report No. 24

RECREATIONAL USES OF MARINE RESOURCES IN THE VIRGIN ISLANDS NATIONAL PARK AND BIOSPHERE RESERVE: TRENDS AND CONSEQUENCES

Recreational uses of the waters of Virgin Islands National Park and Biosphere Reserve on St. John, U.S. Virgin Islands, have increased dramatically in the last 10 years. Recreational visits to the park have risen from less than 100,000 prior to 1967 to over 750,000 in 1986. Annual visitation to Trunk Bay beach, the most heavily used beach in the park, has risen from under 20,000 people in 1966 to almost 170,000 in 1986. The average number of boats in park waters ranged from less than 10 in 1966 to about 80 in 1986.

One consequence has been the degradation of the park's marine resources, particularly some of the coral reefs and seagrass beds along the north shore of the island which receives the heaviest use. Anchor damage and damage from boats striking or grounding on reefs is evident. Seagrass beds in popular bays have deteriorated.

Based on field work and examination of National Park Service records, this report documents some of the trends and consequences of increased recreational uses of the park's resources and some recent efforts to protect them. It's purpose is to provide a basis for future management actions designed to balance increased visitation with protection of fragile marine resources.

ABSTRACT

Biosphere Reserve Research Report No. 25

ASSESSMENT OF ANCHOR DAMAGE AND CARRYING CAPACITY OF SEAGRASS BEDS IN FRANCIS AND MAHO BAYS FOR GREEN SEA TURTLES

Over the past two decades, there has been a serious decline in the seagrass beds in Francis and Maho Bays, St. John, U.S. Virgin Islands. These beds provide habitat and food for one of the largest populations of the endangered species of sea turtles, Chelonia mydas L., the green sea turtle, in U.S. jurisdiction. The population size was estimated at 50 subadult turtles. These turtles exert heavy grazing pressure on the leaves of their preferred food, the seagrass Thalassia, in the bays. In addition to grazing pressure, the seagrass beds are seriously disturbed by the increasing number of boats that anchor in the seagrass, damaging roots and rhizomes. Up to 10% of the seagrass beds in the bays is presently damaged by anchors.

The effects of the grazing and anchor damage were evident in the extremely low productivity of the fragile, achlorotic, short and narrow Thalassia leaves. A carrying capacity for the turtle population was calculated based on this productivity and the feeding requirements of the turtles, estimated by observing turtles directly and remotely using radiotelemetry. The carrying capacity was estimated at 11-31 subadult turtles, indicating that the population may be in danger of decline. The grazing behavior of the turtles differed from the patterns reported previously in that the turtles fed throughout the day without taking characteristic midday breaks in feeding. This difference may be in response to the poor quality and quantity of food provided by the seagrasses in the bays.

Although anchor scars in the bay recovered little during the course of the study, some recovery of Thalassia occurred inside fences that excluded anchor damage and turtles. After 3 months, Thalassia blades inside the fences were significantly longer than outside and the productivity per shoot increased.

In order to protect the turtle population from further habitat degradation, it will be necessary to reduce the damage done by boats in anchoring the seagrass beds in the bays.

ABSTRACT

Biosphere Reserve Research Report No. 26

BUCK ISLAND FISH AND SHELLFISH POPULATIONS

A fish and shellfish (conch and lobster) population study was conducted from November 1985 through June 1986 at Buck Island Reef National Monument (BUIS), St. Croix, U. S. Virgin Islands. The objectives of the project were: (1) to replicate fish census studies conducted by previous researchers in BUIS and compare their results to the present study; (2) to evaluate the impact of commercial trap fishing on BUIS reef fish and lobster populations; (3) to collect baseline data on conch and lobster populations at specific sites within BUIS; (4) to determine the effectiveness of the protective legislation at BUIS in sustaining or increasing fish and shellfish populations; and (5) to develop a long-term monitoring scheme for BUIS fish and shellfish populations.

Based on reef fish community census studies at BUIS, an area of limited fishing pressure, and Tague Bay, an area of unrestricted fishing pressure, BUIS reef fishes are decreasing at a rate equal to or greater than reef fishes at Tague Bay. The most abundant group of commercially important reef fish species present within BUIS are the herbivores, represented by the surgeonfishes (blue tang, and ocean surgeonfish) and parrotfishes (stoplight, princess, redtail and red band).

Mean conch density in the seagrass bed west of Buck Island for the six-month study period was 1 conch/7m^2. More than 98% of the conch censused were juveniles--those lacking a flared lip.

The average density of Caribbean spiny lobster for the six-month study period at the west patch reef (WPR), north patch reef (NPR) and south fringing reef (SFR) was 1.2 lobster/624 m^2, 1.5 lobster/165 m^2 and 1.3 lobster/1500 m^2, respectively.

Based on past sampling interviews with commercial fishermen and fish trap studies conducted in BUIS, estimates on commercial fishing effort with fish traps in BUIS indicate that 6,656 lbs. of reef fish and 1,996 lbs. of lobster may be removed from BUIS waters each year by 16 fish traps hauled twice/week. Additionally, an estimated 8,320 lbs. of fish are removed by 29 fish traps adjacent to BUIS waters. Although limited to two lobster and two conch/person/day from BUIS waters, the recreational harvest of these resources, unknown at present, may be substantial, based on 60,000 BUIS visitors/year.

Due to the small size of the protected area afforded by BUIS, reef fish and shellfish (conch and lobster) are adversely impacted by a relatively small but concentrated commercial and recreational fishing effort both in and adjacent to park waters. This impact may be exacerbated by the environmental degradation of the coral reef ecosystem due to natural and man-induced causes.

ABSTRACT

Biosphere Reserve Research Report No. 27

INITIAL INVENTORY OF THREE PERMANENT FOREST PLOTS IN THE VIRGIN ISLANDS NATIONAL PARK

A quantitative forest inventory was conducted in three permanent study plots within the boundaries of the Virgin Islands National Park on the island of St. John, U.S.V.I. Plot One, on Bordeaux Mountain, is located in the Reef Bay watershed and is 1 hectare (ha) (100m x 100m). Plot Two is found in the L'Esperance area of St. John in the Fish Bay watershed and measures .5 ha (50m x 50m) in area. Plot Three is located on the north coast of the island in the Hawksnest Bay watershed and is also .5 ha (50m x 50x). All stems with a diameter at breast height (DBH, at 1.3 meters) greater than or equal to 5cm were sampled. Information gathered included taxonomic identification, DBH measurements in centimeters, tree heights in meters and spatial distribution within the study plot. With these data, basal area, relative density, relative dominance and relative frequency values were calculated by species.

Plot One (Bordeaux) is located in upland moist forest. A total of 62 species were identified representing 33 families with a basal area of 31.08 square meters from the 2348 stems sampled. The five most important species based on calculation of ecological importance value or I.V. (sum of relative density, relative dominance and relative frequency values) included: Guapira fragrans (I.V.=34.79); Pimenta racemosa (I.V.=32.37); Inga fagifolia (I.V.=31.61); Acacia muricata (I.V.=29.20); and Byrsonima coriacea (I.V.=25.66). Together these five species make up 51.19% of the total importance value.

Plot Two (L'Esperance) is also located in upland moist forest. A total of 39 species were identified representing 26 families with a basal area of 15.82 square meters from the 1199 stems sampled. The five most ecologically important species included: Ardisia obovata (I.V.=67.35); Guapira fragrans (I.V.=38.08); Inga fagifolia (I.V.=21.00); Andira inermis (I.V.=19.09); and Ocotea coriacea (I.V.=13.74). These five trees make up 53.09% of the total importance value.

Plot Three (Hawksnest) is located in the dry evergreen woodland vegetation type. A total of 54 species representing 26 families were identified. The total basal area for the plot was 13.269 square meters from the 1327 sampled stems. The five most ecologically important species included: Melicoccus bijugatus (I.V.=102.67); Guapira fragrans (I.V.=28.46); Bursera simaruba (I.V.=16.23); Ocotea coriacea (I.V.=15.38); and Krugiodendron ferreum (I.V.=12.80). Melicoccus bijugatus an introduced species, makes up 34.22% of the importance value and the five combined total 58.51% of the importance value.

Each study plot has been located in a critical study watershed as determined by VIRMC. The study will be long-term (20 years) and will generate information on the dynamics of secondary forests including growth rates, basic ecology, phytosociology, impact of previous land use

practices, and the role of exotic plant species. Information gathered from this study will provide information to develop strategies for forest management, ecosystem restoration and rare species conservation. It is hoped that this initial inventory will also facilitate additional ancillary studies both in the permanent plots as well as in the watersheds where they are located.

ABSTRACT

Biosphere Reserve Research Report No. 28

GEOCHEMISTRY OF ST. JOHN AND INFLUENCE ON MARINE SYSTEMS

This study was conducted to determine if three geochemical anomalies in St. John, USVI contribute significant amounts of heavy metals to near shore marine ecosystems. Stream water, sea water, marine sediments, and marine organisms from five watersheds were analyzed for Fe, Mg, Mn, Cu, Cr, Ni, and Zn in order to determine the transport of the metals.

Metal concentrations in stream water were typical of small, unpolluted streams, and only iron exceeded the U.S. EPA water quality standard. Magnesium was transported primarily in the dissolved phase, and iron and manganese were transported in the particulate phase. The streams did not appear to have consistently lower or higher concentrations of the metals, but Coral Bay had markedly higher iron and copper than the other streams.

Annual metal export was estimated for Fish Bay Gut. Mg and Fe were exported in quantities greater than 100 kg; the other metals only rarely exceeded this quantity. There was great variability in annual export rates depending primarily on the magnitude and frecuency of rain events.

Sea water samples also had low metal concentrations, but iron and manganese exceeded U.S. EPA water quality standards. There was considerable variability in metal concentrations among the sampling sites.

Marine sediments also had low concentrations and high variability among the samples. Intensive sampling conducted in Fish Bay showed that Mn, Ni, and Fe were horizontally zonated with respect to the discharge point of Fish Bay Gut. The high concentrations found in sediments make this sample type the easiest compartment for heavy metal monitoring.

Snails, crabs, and sea urchins from Fish Bay were analyzed. Snails and crabs appear to be good indicator organisms because the levels of heavy metal present in their tissue is well above the detection limit of the standard analytical techniques.

The geochemical anomalies do not pose a serious threat to the marine ecosystems of St. John island.